THE PROGRESSIVE FISH CULTURIST

NEWS AND VIEWS FROM MANY SOURCES ON PRACTICAL HATCHERY PROBLEMS

ISSUED BY THE

U. S. DEPARTMENT OF COMMERCE
DANIEL C. ROPER, SECRETARY

BUREAU OF FISHERIES
FRANK T. BELL, COMMISSIONER

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THE PROGRESSIVE FISH CULTURIST

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Editor

Elmer Higgins, Chief, Division of Scientific Inquiry, U. S. Bureau of Fisheries.

Associate Editors

Dr. H. S. Davis, In Charge, Aquicultural Investigations, U. S. Bureau of Fisheries.
Professor Lauren R. Donaldson, School of Fisheries, University of Washington.
Dr. A. S. Hazzard, Institute for Fishery Research, University of Michigan.
M. C. James, Assistant Chief, Division of Fish Culture, U. S. Bureau of Fisheries
Dr. A. H. Wiebe, Biological Readjustment Unit, Tennessee Valley Authority.
Dr. Louis E. Wolf, New York Department of Conservation.

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THE USE OF OAT FLOUR COMBINED WITH SALMON MEAL IN THE DIET OF FINGERLING SILVER SALMON (Oncorhynchus kisutch)

By Lauren R. Donaldson, School of Fisheries, University of Washington, and Fred. J. Foster, U. S. Bureau of Fisheries.

CEREALS HAVE been used as a portion of the diet for trout and salmon for many years. Only recently, however, a renewed attention has been focused on the part played by cereals in the diet. This problem has been forced to the foreground by the increased use of food concentrates, such as fish meals, salmon egg meals, etc. in the diets. The cereals are either mixed with the meal to add bulk together with some food value, or are cooked with water and added to the meat and meal combinations prior to feeding. Another possible function of cereals, especially oat flour, may be the retardation of the oxidation of the fish oils contained in the fish meals.

At the suggestion of Mr. Roger Harrison, Associate Technologist, U. S. Bureau of Fisheries, a number of combinations of salmon meal and oat flour were prepared at the plant of the U. S. Bureau of Fisheries at Quilcene, Washington (Donaldson & Foster, 1936)1/. While these combinations of salmon meal and oat flour were primarily designed to form the basis for an analysis of the chemical changes taking place in the meals to which oat flour had been added or omitted, they also are usable by the fish culturist in planning his diet combinations.

Feeding tests

The feeding experiments were carried on at the Quilcene station of the U. S. Bureau of Fisheries. Young silver salmon served as test animals, with 2,000 fish in

1/ Donaldson, Lauren R. and Foster, Fred J., "Processing of Fishery Products into Fish Food." Progressive Fish Culturist, No. 19, pp. 1-6, June 1936.

each lot. Six lots of fish were used in this series of experiments and a summary of results is given in Table I, and Figure 1. (In this figure, the points through which the curves were drawn represent the average weight in grams of samples weighed at four week intervals.) The experiments started as soon as the fish had completely absorbed the yolk sac and were continued for 24 weeks. The water temperature during the experiment ranged from 46° to 50° F.

The control, lot No. 1, received beef liver exclusively. The lots numbered from 2 to 6 received diets composed of 60 percent beef liver and 40 percent by weight of a mixture of air dried salmon meal and oat flour in various proportions.

The fish in lot No. 2 received, in addition to the liver component in their diet, 40 percent of a combination of salmon meal and oat flour, called mixture No. 1 in this report. This mixture was prepared by mixing 2 pounds of oat flour with 200 pounds of cooked ground fish pulp, which was then dried in a tunnel drier. The resultant product contained approximately 5% oat flour after evaporating the water from the fish pulp.

The fish in lot No. 3 were fed liver and 40 percent of mixture No. 2. This mixture was prepared by mixing 5 pounds of oat flour with 200 pounds of fish pulp, and then drying the mixture. The dried meal contained about 89 percent salmon meal and 11 percent oat flour.

The fish in lot No. 4 were fed on a diet of liver to which 40 percent of mixture No. 3 was added. Mixture No. 3 was prepared by adding 5 pounds of oat flour to 50 pounds of air dried salmon meal which yielded a meal containing approximately 9.1 percent oat flour.

The fish of lot No. 5 were fed, in addition to the liver, 40 percent of mixture No. 4, which was prepared by adding 20 pounds of oat flour to 50 pounds of air dried salmon meal, which gave a product with about 28.6 percent oat flour.

Lot No. 6 served as a control for the fish meal-oat flour combinations, the fish in this experimental lot receiving 60 percent liver and 40 percent air dried salmon meal.

In the 24 weeks the experiments were in progress the mortalities were so nominal as to be almost without significance. The percentage mortality was less than one-half of one percent in each of the experimental lots.

The fish in lot No. 1, the control group, produced the smallest total weight increase, required the most food to produce a pound of fish, which was produced at the greatest cost per pound of any of the experimental lots. In the 24 weeks the average increase in weight was 1107 percent; a total of 30,422 grams of food were consumed. A pound of fish was produced from each 3.03 pounds of food fed. The purchase price of the liver used was $0.04 a pound, or the cost for food was $0.121 for each pound of fish produced.

Table 1.

SUMMARY OF EXPERIMENTAL FEEDING TESTS WITH SILVER SALMON FINGERLINGS AT THE QUILCENE STATION

Date experiment started: April 11, 1936 - Concluded: September 25, 1936

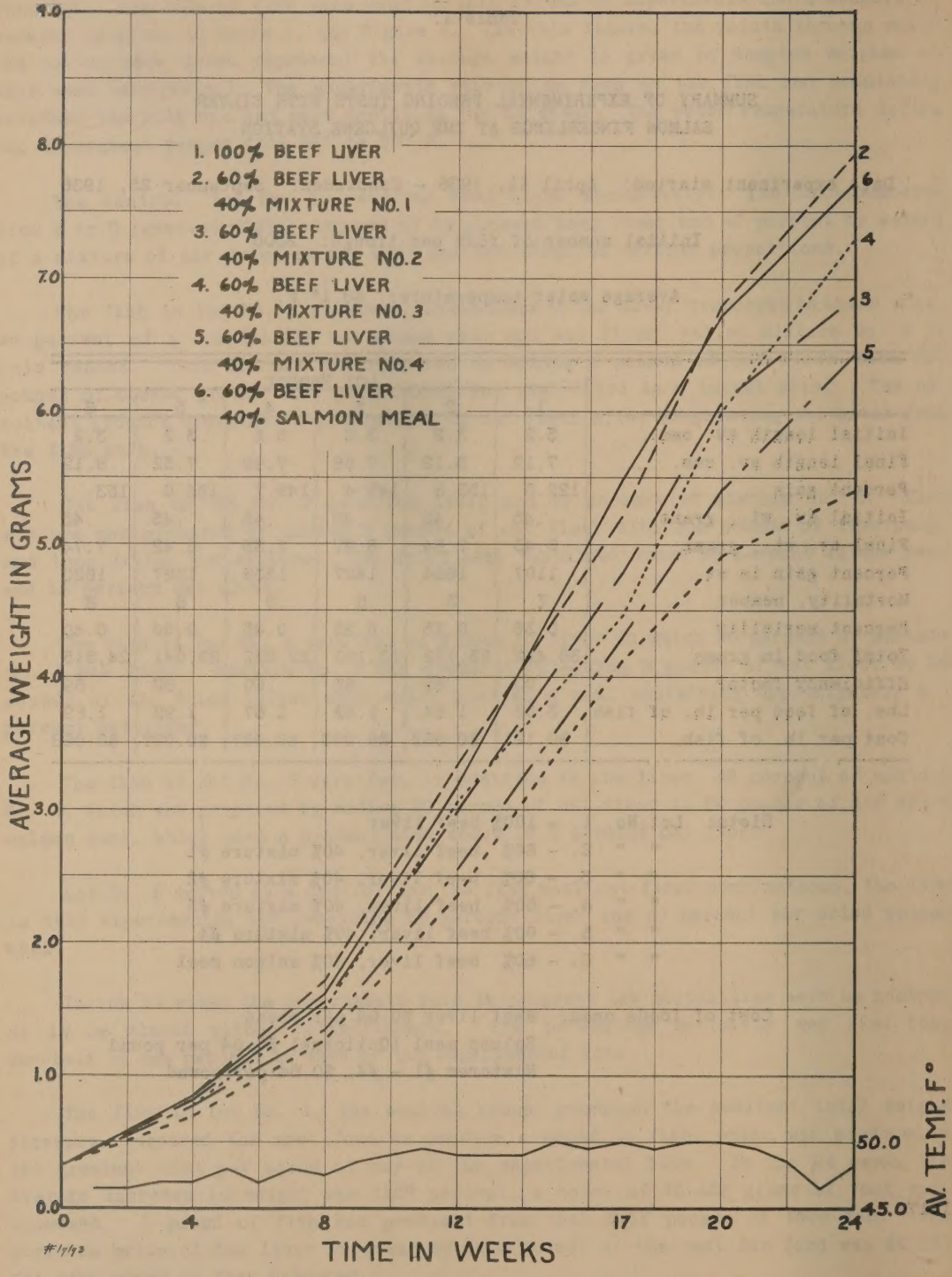
Initial number of fish per trough: 2000

Average water temperature: 48.1° F.

	Lot Number					
	1	2	3	4	5	6
Initial length av. cms.	3.2	3.2	3.2	3.2	3.2	3.2
Final length av. cms.	7.12	8.12	7.98	7.99	7.52	8.12
Percent gain	122.5	153.8	149.4	149.7	135.0	153.
Initial av. wt., grams	.45	.45	.45	.45	.45	.45
Final av. wt., grams	5.43	7.94	6.87	7.35	6.42	7.74
Percent gain in wt.	1107	1664	1427	1533	1327	1620
Mortality, number	7	3	5	9	8	8
Percent mortality	0.35	0.15	0.25	0.45	0.40	0.40
Total food in grams	30,422	23,162	23,191	22,932	23,041	24,515
Efficiency factor	.33	.65	.55	.60	.52	.59
Lbs. of food per lb. of fish	3.03	1.54	1.82	1.67	1.92	1.69
Cost per lb. of fish	$0.121	$0.062	$0.073	$0.067	$0.077	$0.068

Diets: Lot No. 1. - 100% beef liver
" " 2. - 60% beef liver, 40% mixture #1
" " 3. - 60% beef liver, 40% mixture #2
" " 4. - 60% beef liver, 40% mixture #3
" " 5. - 60% beef liver, 40% mixture #4
" " 6. - 60% beef liver, 40% salmon meal

Cost of foods used: Beef liver $0.04 per pound
Salmon meal (Quilcene) $0.04 per pound
Mixtures #1 - #4, $0.04 per pound


1. 100% BEEF LIVER
2. 60% BEEF LIVER
40% MIXTURE NO. 1
3. 60% BEEF LIVER
40% MIXTURE NO. 2
4. 60% BEEF LIVER
40% MIXTURE NO. 3
5. 60% BEEF LIVER
40% MIXTURE NO. 4
6. 60% BEEF LIVER
40% SALMON MEAL
AVERAGE WEIGHT IN GRAMS
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
4
8
12
17
20
24
TIME IN WEEKS
AV. TEMP. F°
50.0
45.0
2
6
4
3
5
1
#1/1/43

The fish in lot No. 2 increased 1664 percent in weight, exceeding all the other lots in this respect. They consumed 23,162 grams of food (60% liver and 40% salmon meal-oat flour mixture); 1.54 pounds of food were required for each pound of fish produced; or at 4¢ a pound for liver and 4¢ a pound for the mixture of salmon meal and 5 percent oat flour, the cost was $0.062 for each pound of increase in the weight of the fish.

The fish of lot No. 3 which were fed liver and mixture No. 2 consumed 23,191 grams of food but required 1.82 pounds of food for each pound of fish produced, at a cost of $0.073. This lot increased 1427 percent in weight during the experiment.

The fish in lot No. 4, fed on mixture No. 3 that contained 9.1 percent flour, consumed 22,932 grams of the liver and meal-flour mixture. In this case 1.67 pounds of food were required to produce a pound of fish at a cost of $0.067 for each pound produced. These fish increased 1533 percent in weight.

The fish in lot No. 5, fed on mixture No. 4 that contained 28.6 percent by weight of oat flour, grew at a rate inferior to that of all other lots of fish receiving salmon meal or salmon meal mixed with oat flour. Their total increase was only 1327 percent; 23,041 grams of food were consumed by the fish in this lot in which 1.92 pounds of food were required to produce a pound of fish at a cost of $0.077.

The growth of fish in lot No. 6, that received salmon meal to which no oat flour had been added, exceeded in growth all the lots that had oat flour in the diet with single exception of those fish in lot No. 2 that received the meal containing 5 percent oat flour. The fish in lot No. 6 consumed 24,515 grams of food, increased 1620 percent in weight, required 1.69 pounds of food for each pound of fish produced, at a cost of $0.068 for food for each pound of fish produced.

Feeding tests using cooked oat flour

To ascertain the effect of cooking the oat flour before mixing it with the liver and salmon meal, two additional lots of fish were carried during the first three months of the experiment. One of these lots, No. 8, was fed a diet made up of 60 parts beef liver, 20 parts salmon meal and 4 parts uncooked oat flour. In the three months test period this lot increased 467 percent in weight and required 2.08 pounds of food to produce a pound of fish. The second lot in this group, lot No. 9, was fed the same mixture as lot No. 8 with the exception that the oat flour was cooked in the ratio of 4 parts oat flour to 16 parts of water before mixing with the balance of the diet. These fish produced growth slightly inferior to that produced by the lot receiving the uncooked oat flour, with an increase of 424 percent in weight in the three months' time. After deducting the water added in cooking the oat flour, 2.00 pounds of the mixed diet were required to produce a pound of fish; thus no great superiority of cooked over the uncooked oat flour in utilization by the fish is apparent.

Summary and Conclusions

Beef liver, salmon meal, and mixtures of salmon meal and oat flour were fed experimentally to young silver salmon fingerlings.

In the feeding tests of 24 weeks duration the lots of fish that received liver combined with air dried salmon meal or salmon meal to which oat flour had been added before or after drying increased in weight at a faster rate, required less food, at a materially lowered cost, to produce a pound of fish than the control lot fed on a diet of 100 percent beef liver.

The addition of oat flour to the fish pulp before drying, in amounts equal to 5 percent of the final product, resulted in a food that when mixed with liver and fed to young silver salmon was superior to those meals that contained no oat flour. Amounts of oat flour in the final salmon meal product, in excess of 5 percent (9.1% to 28.6%), reduced the rate of weight increase and resulted in an increased cost of producing the fish.

Cooking the oat flour before adding it to the salmon meal and liver to form the diet for young silver salmon for a three months feeding test did not significantly increase the utilization of the food by the fish in comparison with a similar lot of fish fed the flour in an uncooked form.

C O N C R E T E

By David C. Haskell, New York State Conservation Department

HATCHERY FOREMEN are of necessity concerned with many types of work other than the propagation of fish. Perhaps the most important of these secondary occupations is construction work. The tasks involved range from small repair jobs to the construction of an entire plant. Among the common types of construction, concrete is of great importance; hence, a brief discussion of this phase of construction may be of interest.

The major qualities desired in concrete are strength and durability. These factors are controlled by the quality of the materials, the proportions of the materials used, and by the relation between the amount of cement and the amount of mixing water.

Very little need be said in regard to the quality of the materials. Washed sand and crushed stone are widely used and are available in most sections. Substitutes for either of these materials should be carefully considered as to freedom from organic material, hardness of the individual particles and durability.

Concrete when poured may be considered as a group of particles of coarse and fine materials (stone and sand) in which each article is surrounded by a "glue" (the cement and mixing water). The total surface of the particles of the materials used roughly determines the amount of "glue" required. This is one of the chief reasons for the use of crushed stone since the total surface of one piece of crushed stone is much less than the total surface of the particles of sand required for a volume equivalent to that of the stone. There are limits however to the amount of crushed stone which may be used in the mixture since it is necessary to fill all of the spaces between the stone. The least amount of sand which can be used is that amount which will fill these spaces. Proportions of sand greater than the least possible amount served to increase the workability of the concrete. Thus a higher proportion of sand is used in small complicated forms than in large mass construction work.

The amount of cement used is often determined as some ratio to the amount of sand and stone as for example a 1:3:5 mixture containing one part of cement, three parts of sand and five parts of stone by volume. This ratio having been determined the amount of water used is often fixed by the appearance of the concrete, water being added to increase workability. An entirely different viewpoint of the method of determining the proper amounts of water and cement to use is becoming quite widely accepted. If we consider the water and cement as a "glue" then it is obvious that if extra water is added to increase workability without adding more cement the "glue" has been diluted and its binding property weakened. Thus the less water used, within reasonable limits, the stronger will be the concrete. Very thorough tests have shown conclusively that the strength of concrete is determined by the amount of water used with each volume of cement, regardless of the quantities of sand and stone used so long as the mixture is plastic and workable. For example, if four gallons of water are used per sack of cement the concrete should have a strength of five thousand pounds per square inch after twenty-eight days of hardening while if eight gallons of water are used per sack of cement the strength will be less than two thousand pounds per square inch.

The quantity of water used also has a great effect on the durability. When concrete hardens a very small porportion of the water chemically unites with the cement. The remainder evaporates, leaving small spaces or voids in the concrete. This is unavoidable. Excess amounts of water, however, increase the number and size of the voids and therefore increase weathering and crumbling. The water-tightness is greatly influenced by the same factors.

Proper mixing has an important bearing on the workability of concrete. Often concrete which appears too dry or too stiff, will prove all right if more thoroughly mixed. Not less than two minutes is required for thorough mixing. The speed at which the mixer operates has very little effect on the time necessary.

The accurate measurement of all materials used per batch will assure concrete of even quality. A shovelful of cement rarely contains the same volume as a shovelful

of sand or stone. On a job of importance it is worth the extra labor to measure each material separately, including the water. A convenient method in cases where the sand and stone are to be wheeled to the mixer is to build a box of correct volume without a bottom, set in the wheelbarrow, fill it, and the lift it off.

Briefly, then, in designing a concrete mixer one should include sufficient sand to thoroughly fill the spaces between the stone and insure workability. Water and cement should the be added in relative amounts depending on the strength of the concrete desired, until the concrete after mixing is sufficiently plastic and workable to be readily placed in the forms. In carefully controlled jobs the amount of moisture in the sand and stone is also considered, although this refinement is probably not necessary in ordinary hatchery work. Probably it would be advantageous to cover the stock pile of sand during heavy rains, so that the unknown quantity of water in the sand would be kept at a minimum. If one wishes to use the older and more established method he should select a mixture, such as the 1:3:5 mix mentioned, which is known to be suitable for the kind of work being done, and then should add the least amount of water necessary to insure workability.

In planning concrete construction, severe weather should be avoided. Pouring concrete during the winter months is at best a difficult job. Methods have been found of reducing the risk involved and these we shall review briefly. None of these methods is a real solution to the problem, but their use will prove a great help when concrete must be placed in cold water.

During the hardening period, the mixing water is removed in two ways. Some of the water chemically unites with the cement; the remainder evaporates. Both of these actions proceed more slowly at low than at high temperatures. When concrete is below 50 degrees F. curing goes on slowly and at 32 degrees F., when freezing occurs, both processes stop.

It is necessary for most of the water to be removed before the concrete will withstand the effects of freezing. It is obvious, then, that the drier the mixture, within reasonable limits, when placed in the forms the less damage will be done. As the water evaporates the concrete gains in strength. This, in itself, aids in combating the effects of freezing. Thus one must protect the concrete in such a way that the normal processes can occur until a point is reached at which the concrete has acquired some strength and the water is nearly gone. Since both the chemical reaction and the evaporation proceed most rapidly for a period of six to twelve hours following the time of mixing then is the most important time to protect the concrete. A considerable amount of heat is produced by the chemical reaction and if adequate protection is afforded during the early stages of curing the heat will be retained and will help in the later stages of the curing process.

The forms provide some protection for the sides of the concrete work. The top of the concrete may also be covered. Canvasses may be used for this purpose although they are not too satisfactory since they often do not cut off a circulation of air which cools the concrete. Sand or manure offer satisfactory protection although they should not be placed directly in contact with concrete. In some cases salamanders, or plaster's stoves, can be used to advantage to keep concrete warm.

A good method to use in freezing weather is to heat the materials. This insures a rapid rate of curing during the early stages causing the concrete to set before it can be damaged. It is important to heat not only the water but also the sand and stone. All frozen lumps of these materials should be removed. Temperatures should not exceed 110-120 degrees, F.

The second method of preventing the freezing of fresh concrete is by the use of chemicals. The addition of common salt or calcium chloride will lower the freezing point of the water. This method is effective for temperatures slightly below freezing although for very low temperatures the amount of protection is insignificant. The addition of these salts has a corrosive action on steel reinforcing and may be objectionable for this reason. In some cases in mass construction work it is possible to protect the top layer with chemicals when sufficient heat will be retained by the main body of the concrete to protect it. Heating the materials and covering the concrete are much to be preferred to the use of chemicals.

When chemicals are employed calcium chloride is probably the best. The chemical should be predissolved in water making a stock solution which is then added to the mixing water in sufficient quantities to produce a two to four percent solution. Quantities giving more than a four percent solution should never be used.

The use of steel reinforcing is a powerful means of increasing the strength of concrete structures. In order to secure the maximum benefit from reinforcing it is necessary to study the deficiencies of concrete.

Concrete has great strength in carrying loads which tend to compress it. Good concrete will under test bear a load of 4,000 pounds per square inch before crumbling. On the other hand it is weak in resisting forces which tend to stretch it - tension forces. The concrete which will stand a compressive load of 4,000 pounds per square inch will break under a load of 300 - 400 pounds per square inch tension. Steel reinforcing is intended chiefly to remedy this weakness.

The need to protect concrete against tension or stretching forces appears at first absurd. A simple example will however show this need. If a concrete beam is supported at the ends and loaded with a weight in the middle this beam will break if the load be great enough. When a beam is loaded it bends downward. This bending causes the bottom of the beam to be stretched, the top to be compressed. When the beam breaks the break is due to the stretching of the bottom of the beam. In other words, it breaks in tension.

If a steel rod is placed lengthwise of the beam and near the bottom it will be bonded to the concrete and when the concrete starts to bend the rod will take the tension. The ridges or barbs on reinforcing rods are to prevent the concrete and steel from slipping on one another.

If the beam with this reinforcing is loaded still more it may break due to a second cause. Another example will illustrate this point. If two "two by fours" are placed together in such a way as to form a beam, and loaded, it is common knowledge that they will stand a much greater load if they are edgewise than they will if laid flat, one on top of the other. When load is applied these "two by fours" bend as did the concrete beam. The tops are compressed and the bottoms stretched.

The strength of a beam increases very rapidly as the depth increases. In the case of the "two by fours" laid flat on top of one another when load is applied and the top is compressed and bottom stretched the bottom of the upper "two by four" slips on the top of the bottom one. Thus we have the effect of two very shallow beams while when the "two by fours" are edgewise they act as a beam a full four inches in depth.

There is a tendency in any beam for the material to slip as did the "two by fours", when load is applied. This action is termed shear. In the case of the "two by fours" placed on top of one another, if they are securely spiked together the effect will be the same as though they were placed edgewise. Similarly if vertical rods are placed in the concrete beam the tendency to shear will be reduced and the beam strengthened.

The principles which have been presented in the case of the beam apply generally to reinforcing work. In considering practical cases the force of water against a dam, the weight of a building on a foundation, etc., are only a part of the forces acting. Frost exerts a powerful force which must be taken care of. In addition special cases often occur, a case in point being a foundation wall built on hard ground at the ends and on soft ground in the middle. Beam action will occur here. Usually a careful consideration of the nature of the forces which will act on a structure will show the points where tension will occur. The possibility of shear always exists between surfaces of concrete one of which is in tension, the other in compression.

D A C T Y L O G Y R U S C O N T R O L I N P O N D S

By O. Lloyd Meehan, U. S. Bureau of Fisheries

OF THE EXTERNAL flukes investigated by Hess 1/ Dactylogyrus was the most difficult to control. In the course of his experiments on goldfish he found that one pound of potassium permanganate to 32,000 gallons of water would kill flukes in one and one-half hours and that Dactylogyrus was killed last. As a result of these experiments he recommended that one should use one pound of permanganate with from 30,000 to 25,000 gallons of water for application to ponds.

At a large goldfish hatchery, the Three Springs Hatchery, Lilypons, Md., most of the goldfish infested by Dactylogyrus were about one to one and one-half inches in length. Observations showed that, in ponds, permanganate treatments equivalent to one pound to 32,000 gallons of water were ineffective to control the spread or to kill the flukes.

Other observations showed that small goldfish seemed to be able to withstand the permanganate better than adults. It was also noted that infested fish tend to collect around shores where the water is quiet and protection may be afforded by

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1/ Hess, Walter N., 1930, "Control of External Fluke Parasites on Fish." Journal Parasitology, Vol. XVI, pp. 131-136

vegetation or depressions in the banks close to the edge of the water. From this it was assumed that most of the infested fish could be reached by an application along the shores a short distance from the edge of the water. Such a method would be advantageous in that all of the food would not be killed and fresh water would be available to the fish.

A technique was developed for applying the permanganate to the ponds. It included a determination of the width and length, and adequate soundings to determine the average depth within a ten foot zone along the banks. The number of cubic feet of water was calculated for the area and one pound of permanganate was used per 100,000 pounds of water (1600 cubic feet).

The permanganate was applied with a sprinkling can by dissolving about a half cup in the can and sprinkling down the shore, at the same time holding the can out at arms length. A return trip was made over the same area, but this time all weed patches, depressions, and other places that might prove a refuge were carefully sprinkled as well as the region close along the water line.

Usually the permanganate on the windward side was dispersed somewhat too rapidly to be effective so a portion was held back to go over such areas a second time. If care was taken in following this procedure and all places which afforded protection for the fish were carefully sprayed, the infestation could be checked by treating the pond twice at about twenty-four hour intervals. However, the treatment must be thorough.

In the course of the experimental work one pond was treated with 1-300,000 (36,000 gallons) of permanganate over the whole surface. Three treatments within four days' time failed to check the infestation and the fish were killed. Pond 5 was treated with 1-267,000 (32,000 gallons) without visible effects on the flukes, but a second application of 1-100,000 over a ten foot area along the shore killed them. Pond 12 was cured with one such treatment because the infestation was detected early. On the other hand pond 81 required three applications because it was flooded by a heavy rain immediately after the first treatment. The following table is a summary of treatments and results at the Three Springs Hatchery:

Date	Pond	Infestation	Treatment	Result
6/9	5	Dactylogyrus and Cyclocheata	1-32,000 gal.	Cyclocheata killed
6/12	"	"	1-12,000 gal.	Cured
6/17	12	Dactylogyrus	1-12,000 gal.	Cured
6/29	seepage	"	1-36,000 gal.	None
6/30	"	"	1-36,000 gal.	None
7/2	"	"	1-36,000 gal.	None
7/7	93	Dactylogyrus and Cyclocheata	1-12,000 gal.	Cyclocheata killed
7/8	"	" "	1-12,000 gal.	Cured
7/7	94	" "	1-12,000 gal.	Cyclocheata killed
7/8	"	" "	1-12,000 gal.	Cured
7/14	81	Dactylogyrus	1-12,000 gal.	Partially flooded
7/15	"	"	1-12,000 gal.	Fewer infested
7/16	"	"	1-12,000 gal.	Cured

Cyclocheata and Costia commonly infest the goldfish studied, but are more easily controlled. Cyclocheata were killed by the weaker concentrations (1-267,000) and Costia yielded to a solution of 1-200,000. The latter left lasting effects in that many of the gill filaments were destroyed to the main cartilage and the gill area reduced to such a point that the fish refused to feed. In this weakened condition they were easy victims for predators. Costia was found only on the gills of the fish in the one pond heavily infested and once or twice associated with other parasites.

GLIMPSES AT FISHERIES BIOLOGY AND FISH CULTURE IN EUROPE (Continued)

II. Germany and France.

By William E. Ricker, Pacific Biological Station, Nanaimo, B. C.

ONE OF THE MOST celebrated hydrobiological institutes of Germany is situated among the glacial hills of Holstein not far from Kiel, in the small but ancient city of Plon. Surrounded by lakes of varied types and sizes, its situation has afforded excellent opportunities for limnological research. Founded in 1892 by the planktologist, Otto Zacharias, the institute in 1917 was brought under the wing of the Kaiser-Wilhelm-Gesellschaft, and in the post-war years had made rapid growth under the vigorous directorship of Professor Dr. August Thienemann.

The first problem of the reorganized institute was a survey and classification of the lakes of north Holstein. The varied life of these lakes was apparent to local fishermen in the kinds of fish present - notably in the presence or absence of pelagic coregonids. By the public at large it was observed that, while some lakes produced immense swarms of large midges, others were quite free from this nuisance - for such they are to the townspeople. These and other differences of biota were summarized by Thienemann in a series of papers, including one of the classics of limnology - "Die beiden Chironomusarten in der Tiefenfauna der norddeutschen Seen" in Arch. f. Hydrobiol. 13; 609-646 - and were convincingly explained by him on the basis of the oxygen content of the lakes in summer and in winter. The later studies of Thienemann have followed along the same lines. To mention only a few, in 1928 was published his general account of the occurrence of oxygen in lakes, and its relation to their organic production; and in the same year a study of the north-German whitefish and the lakes they inhabit. A few years ago he spent some time in the Dutch Indies, studying tropical waters. He is keenly interested in the taxonomy of midges, particularly immature stages, and gives as much time as possible to the rearing and description of larvae and pupae. His position as director of the institute brings him in contact with governmental and other officials (including those from whom financial support must be obtained), and this no doubt has provided part of the incentive for several papers concerning the scope of the study of limnology and its place in modern civilization. In addition, he is editor of the Archiv fur Hydrobiologie, and has been from its beginning the President of the International Association for Theoretical and Applied Limnology.

Collaborating with Thienemann in the necessarily protracted task of describing and preparing keys for the immature midges of Europe is Prof. Dr. Fr. Lenz. Other studies of Lenz include a study of the bottom fauna of lakes - its distribution with depth of water, seasonally, and in the various layers of the ooze, for which latter purpose he devised a special layered dredge. He, too, has made a sojourn in the tropics, northeastern Brzil in this case. He is secretary of the International Association. Privatdozent Dr. Enrich Wasmund might be called a geolimnologist, from his concern for glacial history, sedimentation, ground water, pollen analysis of bogs, and similar topics. He formerly spent some time on Lake Constance, in the study of its currents and sediments. Dr. Hans Utermohl works with plankton and bacteria, and, for the enumeration of such, designed the ingenious yet simple "upside-down" microscope. Dr. Waldemar Ohle is chemist, and stresses the importance of a study of colloidal chemistry in lakes. His important discovery, that phosphates are much less quickly absorbed by colloids in neutral or alkaline solution than in acid, helps to explain some of the differences in productivity between hard and soft water lakes and ponds.

In the Berlin suburb of Friedrichshagen is situated the Prussian Landesanstalt fur Fischerei. Established in 1906, this institute combines the functions of a research laboratory and a graduate training school for fisheries biologists and cemists. From among its students appointments are commonly made to the position of fisheries overseer (Oberfischmeister) in the various German provinces. It also holds courses for working fishermen, which are very well attended. The director is the energetic Prof. Dr. H. H. Wundsch, author of articles in two or three handbooks on various phases of fishery management, and of numerous papers. The research problems of the institute are mostly derived from the immediate needs of the fisheries, and for controlled experiments there are provided adequate outdoor ponds and indoor aquaria. Head of the division of pathology is Privatdozent Dr. W. Schaperclaus, who receives many calls from fishermen, owners of carp ponds, etc., whose fish are dying from obscure causes, or whose ponds have produced a type of "crumpled" carp. Chemical work is directed by Prof. Dr. R. Czensny, and, from their situation near a great city, pollution studies are naturally of great importance. In questions of nutrition, digestion and metabolism Wundsch himself takes a close interest, and has written a resume of what is known on these subjects. At the time of our visit, studies of digestion time in various fishes were being prosecuted by Dr. Hans Mann, a voluntary assistant. Another biologist of the staff is Dr. H. Potonie, who was studying the invertebrate fauna of certain rivers nearby. Another line of investigation pursued at the institute concerns the impregnation of nets with preservatives so as to obtain maximum use.

This is perhaps the place to mention two crustaceans which have become bad pests in northern and central Europe. One is the "mitten crab", so called because of a furry covering on the pincers. It is a true crab which has become adapted to life in brackish and even fresh water. Imported from the Orient in the ballast of freight boats, it is now exceedingly abundant in the Rhine and other large rivers, and a great nuisance to gill-net fishermen by destroying their nets and eating their catch. America will do well to guard against its arrival here.

The other pest is a crayfish of American origin, one of the species of Cambarus. It was introduced originally as an item of human food, to take the place of the native crayfish when that creature was decimated by a disease epidemic. The newcomers proved immune to the disease, and now flourish in many streams, but unfortunately did not "take" so well with the prospective consumers, probably because of their relatively small size. Consequently the re-establishment of the native crayfish in many places will await the extermination of the intruders. The control of these two species presents an urgent and difficult problem to European fisheries biologists.

The last-mentioned species provides an illustration of the fact that whether a species is considered a pest or not depends upon what one is accustomed to. The rivers of eastern America abound in Cambarus of many species; they have never supported any superior and more edible crayfish, so the native stocks are looked upon, without regrets, as an excellent food for fishes. On the other hand consider the carp, which is usually regarded as an undesirable importation in America, and is the object of many campaigns for its control. In Europe, however, it is highly esteemed, supports what is probably the largest fresh-water fishery, and is artificially cultured on a very large scale. My dinner companion at Plon assured me that he considered the carp the finest of all fishes, fresh-water or marine.

In confining the description of German fresh-water fisheries and biological research to the two institutions above, we do an injustice to many others, some of equally well-known, which are supported by administrations or universities in the various provinces and cities. Because of his American visit of several years ago, and his extensive work on variation among Cladocera, the station directed by Prof. Dr. Richard Woltereck, at Seeon in upper Bavaria, will readily come to mind. Readers of the PROGRESSIVE FISH CULTURIST will recall a review made recently by Dr. Hile of the work of Dr. Hans-Joachim Elster on the value of artificial propagation of whitefish in Lake Constance. This work was prosecuted at the Institut fur Seenforschung und Seenbewirtschaftung at Langenargen, on the shores of that lake. But our limited itinerary did not include these and other points of interest, and no attempt will be made to fill in the gaps by referring to publications, if for no other reason than that the list would almost certainly remain incomplete. A comprehensive list of research stations and staffs in Germany, and indeed in the whole of Europe, compiled by someone in close touch with fisheries biology there, would be of much interest and value to scientists of this continent, who are apt to underestimate the work being done across the ocean.

In France, a regrettably short sojourn permitted only two brief visits. At Nancy is situated the Ecole Nationale des Eaux et des Forets, in which the fisheries laboratory is directed by M. le Prof. E. Hubault. Fisheries investigations are carried on in the nearby Vosges mountains, and, from a summer laboratory at Aix-les-Bains on the lac du Bourget, in the region of the French Alps as well. Assistant at Nancy at that time was M. Paul Vivier; more recently, he has been appointed director of a new Centre National d'Hydrobiologie Appliquee, at Paraclet near Amiens.

In Paris we saw M. le Conservateur Kreitmann, Chef de la Commission de Peche. His conversation turned principally on the Limnological Congress which is being held in France this year, and of whose organization committee he is secretary. He and his

committee have gone to great trouble to prepare an interesting program of meetings and excursions, of national and municipal entertainment, and it is to be regretted that distance will probably prevent the attendance of any large number from this side of the Atlantic. Meetings are to be held in the Palais du Bois, on the grounds of the International Exposition. Following the sessions, a ten-day excursion is planned, principally in the mountainous eastern part of the country, visiting various lakes, dams and rivers, and the fish-cultural establishments and fisheries research stations en route. Among the latter may be mentioned those at Nancy, Aix-les-Bains and Paraclet mentioned above, the Station d'Hydrobiologie Grimaldi de la Faculte des Sciences de Dijon at St. Jean-de Losne, and the Institute d'Hydrobiologie et de Pisciculture de l'Universite de Grenoble. A more extended and, in part, alternative excursion will visit the Station d'Hydrobiologie de la Faculte de Montpellier at Sete on the Mediterranean, then spend considerable time visiting lakes at high altitudes in the Pyrenees.

A word concerning the International Association for Limnology (usually designated by its German initials IVL) may not be out of order. Founded in 1922, its purpose was to bring into closer contact the scientists of all parts of the world who are interested in any of the various phases of theoretical or applied limnology-using that word in its widest sense. Its principal accomplishment to date has been the holding of Congresses at (usually) two year intervals. The situations chosen have emphasized the international character of the organization, as Congresses have been held successively in Germany, Austria, Russia, Italy, Holland, Yugoslavia, and now France. Following each congress a volume of Transactions is published, often with substantial financial assistance from the government of the country where the congress has been held, so that very creditable volumes have been the rule. In the membership of the IVL most European countries are represented in numbers which are proportional to the interest which limnology there commands. The same cannot be said of countries outside of Europe, and for an obvious reason: Not many among (for example) American limnologists feel free to join a society whose Congresses they will very seldom, perhaps never, be able to attend. Nevertheless both American limnologists and the IVL lose much by the sparseness of the membership which the association has obtained over here. Possibly some kind of affiliation of the recently organized Limnological Society of America with the IVL could be arranged, whereby members of either could have the privileges of both, including, preferably, any publications issued. (This would presumably be conditional on the American Society's undertaking a publication of some kind). Action of this kind would do much to dispel the cloud of unfamiliarity which to too great an extent conceals the scientific work of either side of the Atlantic from the scientists of the other. It would also strengthen the note of internationalism on which the IVL was founded, and which it continues to uphold against the prevailing temper of the times.

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A LARGE FISH SORTER

By Louis E. Wolf, State Fish Hatchery, Rome, N. Y.

FOR THE PAST two years we have been using a sorter at the Rome Hatchery which is, in our opinion, an improvement over the ordinary metal-rod sorter in general use. In a small, one-man sorter, used for grading fish in troughs, we have found that properly spaced metal rods work very well. But for large-scale grading operations, such as we undertake every September, where a good many hundred thousands of trout are graded in ponds, there are certain objections to the metal rods.

In the first place, metal rods are not very satisfactory unless made of brass or stainless steel. Both of these materials are rather expensive. In the second place, a large sorter made of metal rods is very heavy. This is a serious disadvantage where large-scale sorting operations are involved. Even when metal tubes are used instead of solid rods the sorter is very heavy.

Our pond sorter, shown in the accompanying photograph, is made entirely of wood. It measures 31 by 74 inches, and is 8½ inches deep. Wooden handles are attached for manipulating it. The grating in the bottom, which is removable, consists of cypress strips 13/16 of an inch wide, on the bottom, 9/16 of an inch high on one side and 1-1/8 inches high on the other so as to present a sloping surface when in place. These strips are nailed to two end pieces measuring 1 inch by 1/2 inch and of sufficient length so that the whole grating can fit inside the framework of the box. A wide sloping piece is screwed into each end of the sorter to hold the wooden grating in place. The grader is not adjustable, but the bottom being removable we have a number of separate gratings which fit into it according to the size of the fish we are grading.

The strips with the sloping edges were ripped out for us at the saw mill. We gave them a rough sandpapering, and a coat of tar.

It may be possible that a two-way slope on the strips would work better than the one-way slope we have used. Since our sorter works very well we have not bothered to try any improvements on it. It catches, or gills, a few fish, but not nearly so many as did the metal rod sorter we used prior to the construction of our present wooden one. Almost no fish are injured by the sorting.

Our sorting operations are performed right in the ponds, as the illustration shows. Two men operate a seine, a third man transfers fish from the seine to the sorter, and two men operate the sorter. It therefore takes five men to sort a pond full of fish with maximum efficiency. The smaller fish drop through into the screened box beneath, and the larger fish are dumped over into the other box.

As to the spacing of the strips in the grating, we can not give definite directions. Trout in one hatchery are fatter than in another, and there is also a difference in shape between the various species in any one hatchery. We have adopted the practice of determining the spacing of the strips for any given lot of fish by trials with a small hand sorter. This would sound as though we had to construct a new grating every time we sorted a pond full of fish. As a matter of fact we have been able to get along for two years with only five different gratings.

To us it appears that the advantages of the sorter here described over the metal rod sorter are as follows:

(1) The wooden strips are much cheaper than metal rods.
(2) Wooden strips are much lighter than metal rods.
(3) The wooden strips catch, or gill, fewer fish.

TEACHING BABY SMALL MOUTH AND BABY LARGE MOUTH BASS TO TAKE ARTIFICIAL FOOD

By John L. Brass, Supt. Fisheries Operations,
Hastings Hatchery, Michigan

THE FIRST and most difficult task in teaching young bass to eat artificial food is to overcome their natural fear or shyness of man. This is accomplished by the selection of a food they soon grow to like and almost constant contact with them around the ponds which they inhabit. At the Hastings hatchery, two men are assigned the work of feeding fish. These men are taught a lesson of patience and perseverence that goes far in making their work a success.

The food selected from any number of foods, is fresh beef hearts. This is prepared for use by passing it twice through the smallest plate in our power meat grinder. This reduces it to particles small enough for the mouths of the baby fish. Small quantities are ordered at first and as consumption increases larger quantities are procured. Our policy during the entire feeding season is to avoid waste of a rather costly product. The method of preparing this food is to remove all fat and tough cartilage before slicing for grinding. When the meat is ground a small quantity of salt is added and the food is ready for use.

Feeding baby small mouth bass is started when the advanced fry began to turn gray and are about five-eighths of an inch long. Up to this time their food has been the natural product of the pond in the way of native daphnia or water fleas and other plankton. The growth of this natural food has been greatly stimulated and increased by the introduction of a quantity of barnyard fertilizer into the ponds before filling in the spring in preparation for the season's crop. It is of vital importance that quantities of this natural food be present in the ponds at this time, for this is the period in which the greatest mortality occurs among the baby bass - that period in which they are being taught to take an artificial instead of a natural food.

A brief description of our feeding equipment might be in order at this time. For a container, a one and one-half quart dipper is used. It is not too deep and has a full handle easy to grip and hold. A spoon or homemade ladle consisting of a flattened piece of metal attached to a small wooden handle about eighteen inches in length, which can be flipped in the hand of the feeder so that the small quantity of food at first placed on the spoon can be dexterously thrown on the surface of the water without splash or great disturbance which will frighten the baby fish away. Only sufficient water is added to the meat to permit it to leave the spoon freely and still hold in a body until it strikes the water and then slowly sinks in separate particles temptingly before the baby fish. To get them to take the first mouthful of this food and retain it and return for the second and third morsel is the trick. As their shyness is overcome, first one and then others will take the food and return for more with less fear and more eagerness.

The object of devoting practically all of one's time to this work is to establish small groups of fish that are feeding on this artificial food all around the ponds. These small groups give confidence to others and soon more are coming at the approach of the feeder until a majority of the fish are feeding.

It requires from eight to twelve days to teach a sufficient number of baby bass to take food in a pond in a manner that is at all encouraging to the feeder. This period will vary according to weather conditions and the efforts put forth. If one has a picture in the back of his mind of a pond containing baby bass an inch and a half long following him all along the shore and jumping over each other in their eagerness to get the food he is throwing to them, it will encourage him greatly in the task he may at first have considered as almost hopeless.

The ponds where hand-feeding takes place at this station, range in size from .56 to 2.11 acres in area and are oblong in shape. Some of them have feeding walks two feet wide and elevated from six to twelve inches above water level. These

walks run lengthwise of the ponds through the center and are of great advantage in feeding. They permit easy access over the deeper portion of the ponds where feeding can be done both ways from the walks and the food is held longer in suspension before reaching the bottom, thus giving the fish a greater chance to recover it.

The natural and sometimes overabundant growth of vegetation that these ponds produce, especially if fertilizer is used, becomes a problem as the season advances. A reasonable growth is very essential, but too heavy a growth interferes with feeding. We control this by raking it from the margin of the ponds to permit of a clear feeding space and mowing swatchs with a scythe through the deeper portion of the ponds and removing the surplus, thus providing a clear space for feeding, but still leaving sufficient for cover and a source of natural food supply.

As the fish develop in size and their appetite for this food increases, a larger container and a larger spoon or ladle for scattering the food is used. There is no set rule as to quantity of food to be used at any given time or feeding. The fish themselves will indicate this. When any one group of fish permit the food to go to the bottom, it is time to move on and engage another group.

Wind and temperatures have a noticeable effect in feeding. When the wind blows, the lee side of the pond should be chosen for feeding and the fish take food best when the weather is warm.

A small quantity of epsom salt should be mixed with the food twice a week. When long strings of excrement appear hanging from the vent of the fish, conditions are not right and the quantity of salt should be increased.

As the fish grow larger, the food should be ground through a larger plate. The necessity for feeding food less finely ground becomes clearly obvious to the feeder, as the fish will attack the larger particles of food first and permit the smaller particles to go to the bottom where it is more or less wasted. This waste should be avoided.

No sudden and radical changes in diet should be made, as this invariably upsets and interrupts progress in feeding. If changes are to be made they should be brought about very slowly by mixing small quantities of the new food with the food in use.

The introduction of Daphnia magna into the ponds from time to time during the feeding season has a beneficial effect upon the growth of the young fish. At this station, we have five small concrete ponds where this variety of daphnia is cultured, giving us an almost continuous supply of this natural food during the feeding season. Quantities of the daphnia are scraped from these ponds and transferred to the feeding ponds where it is quickly consumed by the baby bass. This form of daphnia can not be produced by the ordinary rearing ponds in quantities, but must be cultured in ponds built for the purpose where a high degree of pollution and stagnation can be maintained.

The feeding of the large mouth baby bass can be carried out along the same lines as feeding the small mouth. More time, patience and perseverence is required, however, as they do not take kindly to an artificial food.

In instructing the student feeder, a carefully outlined plan of procedure should be laid down and adhered to. Sudden and erratic changes from day to day should be avoided, as this leads to confusion in the mind of the student and an unfavorable reaction among the fish. Time and the results obtained by the student, will tell the story better than anything else as to his fitness for this branch of hatchery work.

AN EDITORIAL

ON EDITORS AND EDITORIAL POLICY

IN OUR ISSUE No. 23 for October 1936, while in the throes of self-analysis we confided to our readers a list of six items under the heading, "What's wrong with the PROGRESSIVE FISH CULTURIST?" With what we regarded as becoming modesty, item No. 5 was entitled "The Editors." Since the publication of that issue we have labored diligently to overcome as many of the faults listed as were within our control, and now, fortunately, reinforcements are at hand to bolster the weaknesses of our editorial personnel.

Listed on the inside cover of this issue are the names of our associates. Well trained and widely experienced in the fields of aquiculture or fishery management, these men can speak authoritatively on a variety of subjects. It is our good fortune that they have agreed unselfishly to give of their time and talents in aiding our journal to fulfill its mission of helping the fish culturists of the country. Many of our readers will know these men personally since they have been selected with an eye to geographical distribution as well as professional merit.

In addition to guiding the policies of the PROGRESSIVE FISH CULTURIST in the future, preventing a repetition of mistakes that have occurred in the past, and raising the general level of quality of the material published, all of the associate editors have volunteered to assist in securing and preparing articles within our field of interest from their various districts, thus serving in a measure as local correspondents. It is hoped, therefore, that fish culturists will be inclined to contribute more freely from their experiences, addressing their views directly to the nearest associate editor, if free expression has been hampered in any way by the formality of addressing the Washington office.

Our board of associate editors has already been functioning. After a lengthy round robin discussion among the group the following general policies have been adopted subject to change in accordance with experience.

Field to be covered: - The objective of the PROGRESSIVE FISH CULTURIST is to promote aquiculture and fishery management in fresh waters. The publication should serve as a medium for the exchange of information and opinions between administrators, biologists, and fish culturists.

Character and subject matter of material: - Articles should have practical application to the above field ranging from fundamental concepts and principles to detailed techniques and procedures. Articles of a more theoretical nature will be published if they are written in an entertaining style and present practical information or personal ideas that enlarge the horizon of the various classes of workers in these fields or provide a background of intelligent appreciation for their daily work.

Extent of editing: - Care will be exercised in selecting material for publication so that only articles containing sound basic facts or reasonable opinions not inconsistent with public policy are chosen. Little editorial work will be done on manuscripts selected aside from simple correction of form. Editorial comment will be restricted to a minimum, but thoughtful articles discussing the philosophy or the general principles of fish culture, fishery management, or fishery administration will be solicited. Criticism by our readers of any phase of the PROGRESSIVE FISH CULTURIST is earnestly requested.

Format: - The present format of the PROGRESSIVE FISH CULTURIST will be continued, using the multigraph and photolith processes for printing and illustrating respectively, with serial numbering of issues as Memorandum I-131 of the Bureau of Fisheries, independent pagination in each issue, and a complete index at the end of each year.

Regardless of the desirability of monthly publication, scarcity of suitable material compels intermittent issue, usually on a monthly basis about nine times a year.

As was noted in the last issue of an esteemed contemporary, FISH CULTURE, published by the Department of Conservation of the State of New York, material formerly published in that journal will be submitted to the PROGRESSIVE FISH CULTURIST for publication.

At the 1936 meeting of the American Fisheries Society Mr. Bost of South Carolina raised the question, "Why is there no modern textbook on fish culture?" In reply we made the boast that material for such a textbook was appearing in the PROGRESSIVE FISH CULTURIST. We have long cherished the hope of publishing a comprehensive account of the great array of modern devices, gadgets if you please, used in every day fish cultural work, but descriptions, diagrams, or photographs of these mechanical improvements have been extremely difficult to assemble. Our boastful promise therefore will fail unless you, our readers, supply the material. Why not take out a "patent" on your new ideas by recording them in the PROGRESSIVE FISH CULTURIST?

THE EDITOR

A CORRECTION

A MISTAKE appeared in PROGRESSIVE FISH CULTURIST No. 31 for July 1937. On page 15 the second sentence should read, "In addition $252,170 was expended for maintenance and operation of its stations." The figure given, $630,250, is the total cost of operating Federal hatcheries and includes the previous item of salaries.

COMMENTS FROM OUR READERS

PROBLEMS OF BASS SURVIVAL IN REARING PONDS

POND NO. 11, a two-acre pond having no connection with other ponds but having a direct flow of water from an artesian well and a heavy growth of vegetation was stocked April 19, 1937 with 30,000 advanced fry. The draining of this pond was completed on September 11 and a total of 24,255 bass three inches in length were removed, or a survival of 80.85 percent.

This pond contained 100 large bluegill bream when the fry were introduced. About 200 No. 2 and No. 3 bream were left in the pond when drained, besides the original stock of 100 adult bream.

This pond had not been fertilized and top water minnows had been planted in the pond one time. One adult top minnow remained in the pond.

Other ponds were handled in practically the same manner this season with low survival. This brings on another problem in fish culture which we hope to find the answer for. We believe the large survival was due to the abundant vegetation in the pond at the time the fry were introduced, as other ponds with lower survival had less vegetation when the fry were planted.

We are certain of one thing - that bluegill bream make a good forage fish for young bass.

Charles R. Wiant, Supt.
U. S. Fisheries Station
Marion, Alabama

BLUE HERONS AND TROUT

WE HEAR and read a great deal about blue herons, but there still seems to be some difference of opinion as to the actual damage they are capable of doing at a trout hatchery. Just recently at the New York State Hatchery at Warrensburg we obtained evidence against these birds which satisfies us that they are bad actors and must be held in check as much as possible.

In August, this year, we sorted out 30,000 trout to hold through the winter, and they were actually counted so that we knew how many we had. They were put in tanks and troughs to be held until the balance of our fish were shipped out, when we could thin them properly and put the correct number in each tank for the winter. 20,000 trout were held in the hatchery and 10,000 were put in four rearing tanks outdoors on August 25th. It was this last lot of trout with which we experienced the trouble from the blue heron.

At Warrensburg all our outside rearing tanks are covered by screens, so we have made no drive to kill fish-eating birds. We assumed that our fish were safe. At the time our trout were put out we were also repairing and painting covers, and old covers were used on some of the tanks during that time, including the four containing our sorted trout.

On August 31st we started to recount the fish and to put 1,000 in each tank for the winter. The first two tanks held up to the original numbers, 2944, put in on August 25th. The third tank showed a shortage of 74 fish, and the fourth a shortage of 593 from the original number of 2278 each. We were at a loss to account for this, not thinking of birds because the tanks were screened.

Early on the morning of September 5th, I discovered a blue heron standing on the tanks and apparently fishing. He flew away before I could get a gun and get near enough to shoot. On examining the tanks I found that one of the old covers being used had a board on one end with a piece broken off, leaving about a 2½ inch opening which the screen did not cover. Water was splashed all around the opening, showing that the heron had been at work and that he was fishing when I first noticed him. We immediately made another count of the fish in this tank and found 78 more missing, or a total of 745 from August 25th to September 5th. The other tank which before had shown a shortage had not been touched this time although the covers had a 2-inch opening at one place. We corrected this condition at once by getting the proper covers to go with the screens, and have had no further trouble.

We saw the heron several times after this, and on the morning of September 9th he was shot in our supply pond. His stomach contained two partly digested 6-inch fish which I believe were trout, but they were not of the right size to be from our hatchery.

One heron was all that was seen during the time or loss occurred, and none was seen for several days after this one was shot. This would indicate that one bird did

the damage. We cannot be positive of this, however. We do know that during a period of eleven days one or more blue herons took 745 trout averaging 4½ inches in length and weighing approximately 26 pounds. At Warrensburg there are screens to prevent this, but we have learned that they are not effective unless properly used, as a heron can fish through a mighty small opening.

K. B. Nichols
State Fish Hatchery
Warrensburg, New York.

INGENUITY AND A WILD IMAGINATION SOLVE THE KINGFISHER PROBLEM

For Our Anonymous Contributor from Fremont, Ohio

The Progressive Fish Culturist
Washington, D. C.

Gentlemen:

WE HAVE been troubled with kingfishers in our private hatchery and after reading in the PROGRESSIVE FISH CULTURIST about putting wires over the ponds to keep out these birds we tried it.

We found, though, that the kingfishers sat on the wires. After some deliberation we ran a pipe carrying water under high pressure along one side of the pond with nozzles attached at frequent intervals. The wires were hooked to the nozzles with a delicate mechanism so that when the birds lit on the wires a stream of water would spurt at them and scare them. It certainly worked. The birds don't sit on the wires anymore. They sit on the nozzles now.

On another pond we planted morning glories to twine over the wires. It looks nice now. It doesn't keep out the kingfishers but enough birds roost in the morning glories so we don't need to fertilize the pond anymore.

In all the other ponds the kingfishers have been effectively eliminated. We took the biggest and most ferocious of our brood stock of trout and gave them some special treatment. First we fed them little insects, then bigger ones. After we had fed them the largest bugs we have here we got some really big grasshoppers from out west. Then we started tying feathers on these grasshoppers, a few more feathers each day. Then we fed them young sparrows and gradually fed them bigger ones. When they had gotten to eat adult sparrows we started painting these birds to look more and more like kingfishers.

First we threw the food on the water. Then we tied their food to strings and each day hung it a little higher over the ponds so they had to jump higher to get it. Now as soon as a kingfisher flies over the vicinity of the ponds these big fish right up and take after him.

In the two ponds with the wires the trout are afraid to jump for fear of hitting the wires and the kingfishers are still active. Our method doesn't work so well for great blue herons.

Yours truly,

Predator Expert

REVIEWS

METHOD AND APPLICABILITY OF THE QUININE BATH, AND SEVERAL OTHER OLD AND NEW BATHS (Collargol, Methlene Blue, Acriflavine, Table Salt), IN COMBATING ONE-CELLED SKIN PARASITES OF FISH.

By Prof. Wilhelm Schaperclaus, Berlin Wochenschrift fur Aquarien - und Terrarienkunde, 1936, Nos. 32, 33, 34, 35.

THE AUTHOR experimented with warm-water fish (Carassius vulgaris, carp, and tench) infested with Chilodon cyprini, Cyclochaeta domerguei, and Costia necatrix. The baths consisted of weak solutions of various quinine salts. Concerning the comparative value of these various salts the author shows that their effect depends upon the amount of quinine they contain. Thus quinine hydrochloride contains 82 parts of quinine per 100, quinine sulphate 73 parts, acid quinine hydrochloride 75 parts, and acid quinine sulphate 59 parts. Therefore, it requires a stronger solution of acid quinine sulphate as to be as effective any given solution of quinine hydrochloride, etc.

No attempt was made to determine the strongest solution the fish could stand, but rather to find the weakest solution which would kill the parasites in long treatments. As a result of his experiments the author recommends the following treatments:

A solution of one gram of any of the above-listed quinine salts in 50 liters of water will kill parasites in the following periods: Costia, 26 hours; Chilodon, 18 hours; Cyclochaeta, 6 hours.

Previous experiment have shown that such quinine baths are also effective on Ichthyopthirius. They do not kill the forms embedded in the skin, but only the free-swimming forms. One gram of quinine sulphate in 10 liters of water kills free-swimming forms in 45 minutes. One gram in 100 liters of water kills the parasites in seven hours.

Dactylogyrus and Gyrodactylus proved much more resistant to quinine baths than did Chilodon.

A number of other substances were tried out to determine how they compared with quinine in combatting external parasites.

a) Collargol.

Collargol is a colloidal silver compound. It has been recommended for combatting Saprolegnia and baceterial skin and fin infections. It was found to be useless on Chiloden as the fish (Carassius) proved more sensitive to the chemical than did the protozoan.

b) Methylene Blue.

Methylene blue has been frequently recommended for Ichthyophthirius. The author used 3 cc. of a 1% water solution of Methylene Blue B in 10 liters of water. This solution required several days to kill all the Chilodon on carp at a temperature of 15 C. The fish stood the bath very well. It did not kill Ichthyophthirius embedded in the skin. Nor was it effective against Gyrodactylus during a five-day bath.

c) Acriflavine (Trypaflavine).

A solution of 1:100,000 of Acriflavine killed all Chilodon on carp within 10 hours, which was more effective than quinine baths. The carp stood this concentration for 10 days without injury.

d) Salt.

This was the only substance with which short baths in strong solutions were tried.

The author states that stronger than 1 percent solutions should not be used on small fish (Caraccius and carp) as it injures them. He found, however, that such weak solutions killed Chilodon in from 1 to 2 minutes, and Costia in 15 minutes. He therefore remmends that if the identity of the parasite is not established before treatment a 1% solution be used for 20 minutes.

In conclusion the author recommends that for combating Costia, Chilodon, and Cyclochaeta salt is best for short treatments, and that for long treatments two compounds have proved themselves useful: quinine salts, and Acriflavine.

Louis E. Wolf

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POND FISH CULTURE

By Percy Viosesa, Jr., Pelican Publishing Company, New Orleans, La., 1937

BIOLOGISTS AND fish culturists who have been flirting with the idea of writing a handbook on pondfish culture can throw away their notes. Mr. Viosca has beaten you to it and has done an able workmanlike job.

This volume of 260 pages, described on the jacket as "A handbook on the culture of warm-water game fishes of the United States" serves two purposes. It supplies the prospective amateur fish culturists - be they farmers, sportsmen's organizations, estate owners, or just plain experimenters - with all they need to know on the foregoing subject. For the professional practitioner it furnishes a restatement and summary of the generally known and accepted facts upon which current practices in pondfish culture are or should be based.

The character of the work can best be indicated by citing the contents. After a rather unnecessary introduction there is a discussion of the principal members of the Centrarchidae with illustrations. This is followed by discussion of the requirements for a site and citation of technical data covering pond construction, etc. The book then swings into an outline of management practices, touching on vegetation, brood stock, and the production of food. Pond fertilizers, the transportation of the fish, cultivation of food organisms, and related subjects, are touched on. There is an interesting chapter on the production potentialities of inland waters. Numerous references are given to show the wide range in the production of fish flesh poundage under varying conditions. This is followed by a more or less philosophical review of fish culture and conservation in inland public waters, with a due amount of attention given to the necessity for the improvement of stocking methods as distinct from the actual propagation.

Mr. Viosca has drawn upon the findings of his contemporaries freely and liberally and there is frequent citation of Drs. Davis, Embody, Wiebe, Hubbs, and others.

The book has some excellent line drawings illustrative of the details of pond construction and quite a few photographs.

Undoubtedly, most of the readers who are now practicing fish culturists will take occasional exception to some of the individual statements made and theories suggested because their own experience may not have substantiated them in full. This is no way detracts from the fundamental value of the book and Mr. Viosca is to be congratulated on having met a pressing need in such a capable manner. In fact, this work is a service to current pondfish culture similar to that rendered by Norris and Livingstone Stone to early salmon and trout culture. In the opinion of the reviewer it is a "must" book in the library of any fish cultural institution. The list price, however, is $4.00.

M. C. James
Assistant Chief, Division of Fish Culture
U. S. Bureau of Fisheries

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By Percy Viosca, Jr., Vellum Publishing Company, New Orleans, La., 1937

BIOLOGISTS AND fish culturists who have been flirting with the idea of writing a handbook on pondfish culture can throw away their pens. Mr. Viosca has beaten you to it and has done an able workmanlike job.

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